

Forest Insect and Disease Conditions in the Rocky Mountain Region 1997-1999



United States
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Agriculture

Renewable
Resources
Forest Health
Management

Rocky
Mountain
Region

FOREST INSECT AND DISEASE CONDITIONS IN THE ROCKY MOUNTAIN REGION 1997-1999

by
The Forest Health Management Staff

Edited by Jeri Lyn Harris, Michelle Frank, and Susan Johnson

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Cover: Aerial photograph taken by Robert D. Averill on October 29, 1997, just days after a blowdown event occurred on the Routt National Forest. The picture was taken looking east toward a blowdown area that straddles both the Mt. Zirkel Wilderness and the Routt National Forest.

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ACKNOWLEDGEMENTS

The Forest Health Management (FHM) Staff of the Renewable Resources Unit extends appreciation to all cooperators who contributed to Forest Health Management in the Rocky Mountain Region.

COLORADO	<p>Jim Hubbard, State Forester Colorado State Forest Service 214 Forestry Bldg.- Colorado State Univ. Fort Collins, CO 80523 Phone: 970/491-6303 Fax: 970/491-7736</p>	<p>Dave Leatherman, Entomologist Mike Schomaker, Plant Pathologist Colorado State Forest Service 214 Forestry Bldg.- CSU Fort Collins, CO 80523 Phone: 970/491-6303 Fax: 970/491-7736</p>
KANSAS	<p>Raymond G. Aslin, State Forester Kansas Forest Service 2610 Claflin Road Manhattan, KS 66502 Phone: 785/532-3300 Fax: 785/532-3305</p>	<p>Bill Loucks, Conservation Forester Kansas Forest Service 2610 Claflin Road Manhattan, KS 66502 Phone: 785/532-3300 Fax: 785/532-3305</p>
NEBRASKA	<p>Dr. Gary L. Hergenrader, State Forester Nebraska Forest Service 103 Plant Industry – Univ. of Nebraska Lincoln, NE 68583 Phone : 402/472-1467 Fax : 402/472-2964</p>	<p>Mark Harrell, Entomologist Laurie Stepanek, Technician 103 Plant Industry – Univ. of NE Lincoln, NE 68583 Phone : 402/472-6635 or -5503 Fax : 402/472-2964</p>
SOUTH DAKOTA	<p>Ray Sowers, State Forester Division of Resource Conservation and Forestry - Foss Building, 523 E. Capitol Avenue Pierre, South Dakota 57501-3182 Phone : 605/773-3623 Fax : 605/773-4003</p>	<p>John Ball, Entomologist (1997-1998) Henry Burkwhat, Forest Health Specialist (1998 - 2001) SD Dept. of Agriculture 3305 ½ W. South Street Rapid City, SD 57702 Phone: 605/394-2395 Fax: 605/394-2549</p>
WYOMING	<p>Tom Ostermann, State Forester Wyoming State Forestry Division 1100 West 22nd Street Cheyenne, Wyoming 82002 Phone : 307/777-7586 Fax : 307/637-8726</p>	<p>Lia Spiegel, Entomologist (1997-1998) Les Koch, Forest Health Specialist (1998 - present) Wyoming State Forestry Division 1100 West 22nd Street Cheyenne, Wyoming 82002 Phone : 307/777-7586 Fax : 307/637-8726</p>

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This report, although completed in 2001, covers Forest Health Management work and the insect/disease conditions of the Rocky Mountain Region for 1997-1999. Many of the original assumptions and predictions made during those years are presented in this report without editing changes. A report about Forest Health Management work and the insect disease conditions of this region for 2000-2001 is in production and should be distributed in Feb. 2002. Please forward comments/concerns about this report or other forest health issues to the Forest Health Group Leader, FH monitor, or the service center leaders. Contact information and addresses are listed on page 5.

Rocky Mountain Region (R2), Forest Health Management of 1997-1999

Forest Health Management (FHM) is responsible for the detection, evaluation, and suppression of insects and diseases on forested Federal lands. FHM also administers financial and technical assistance programs with the State Foresters of Colorado, Kansas, Nebraska, South Dakota, and Wyoming. In addition, the management of range pests and gypsy moth are a shared responsibilities with the Animal and Plant Health Inspection Service (APHIS). Close coordination and cooperation of the Federal and State agencies responsible for forest health management are necessary for effective program execution.




Three Service Centers and the Regional Office address forest health concerns of the Rocky Mountain Region. Questions concerning operations and requests for service can be directed to the Forest Health Management (FHM) Group Leader in the Regional Office or the respective Service Center Leaders.

<u>SERVICE CENTERS and OFFICES</u>	<u>SERVICE AREAS</u>	<u>STAFF</u>
Lakewood Service Center (LSC) Building 20, Denver Federal Center Ph: 303/236/9541 Fax: 303/236-9542 <i>(Service Center Leader contact at time of report – Jeff Witcosky)</i>	Assistance to Kansas, eastern and northwestern Colorado, and southern Wyoming; National Forests: Pike, Arapaho-Roosevelt, Medicine Bow-Routt, and White River (Dillon Ranger District), Comanche and Cimarron National Grasslands	Dave Johnson - Service Center Leader, Plant Pathologist Bill Schaupp – Entomologist Erik Johnson – Aerial Survey Specialist Bernard Benton - Computer Specialist
Gunnison Service Center (GSC) 216 North Colorado, Gunnison, CO 81230 Ph: 970/641-0471 Fax: 970/641-1928 <i>(Service Center contact at time of report is unchanged)</i>	Assistance to National Forests and cooperators east of the Continental Divide in Colorado: Rio Grande, San Isabel, San Juan, Grand Mesa, Uncompahgre, Gunnison, and White River	Roy Mask – Service Center Leader, Entomologist Tom Eager – Entomologist Pete Angwin (1997-1998), Jim Worrall (1999) – Plant Pathologists
Rapid City Service Center (RCSC) 803 Soo San Drive, Rapid City, SD 57702 Ph: 605/343-1567 Fax: 605/343-7134 <i>(Service center contact at time of report -)</i> 1730 Samco Road, Rapid City, SD 57702 Ph: 605/343-1960 Fax: 605/394-6627	Assistance to National Forests, and cooperators east of the Continental Divide in northern Wyoming, South Dakota and Nebraska: Black Hills, Bighorn, Shoshone, and Nebraska, and National Grasslands in South Dakota, Wyoming, and Nebraska	Judith Pasek (1997), Kurt Allen (1998-99) – Service Center Leaders, Entomologists Joel McMillin – Entomologist (1998-99) Jeri Lyn Harris – Plant Pathologist Tom Juntti – Forest Technician (1997-98)
Regional Office – Forest Health Management (FHM) 740 Simms Street, Golden, CO 80401 Ph: 303/275-5061 Fax: 303/275-5075 <i>(Group Leader contact at time of report – Frank Cross; FH Monitor – Jeri Lyn Harris)</i>	Assistance to the three service centers and liaison to Washington D.C. offices.	Robert Averill - Group Leader Michelle Frank – Forest Health Monitoring Coordinator Susan Johnson – Biologist, Pesticide - Noxious Weed Coord.
Regional Office – Renewable Resources <i>(Director contact at time of report – Marisue Hilliard 303-275-5014)</i>	Oversight of Forest Health Management for R2	Dave Anderson – Director

Rocky Mountain Region Forest Health Management Zones



Service Center Zones by forest

-  **Gunnison Service Center**
-  **Lakewood Service Center**
-  **Rapid City Service Center**

1998 Rocky Mountain Region Forest Health Management



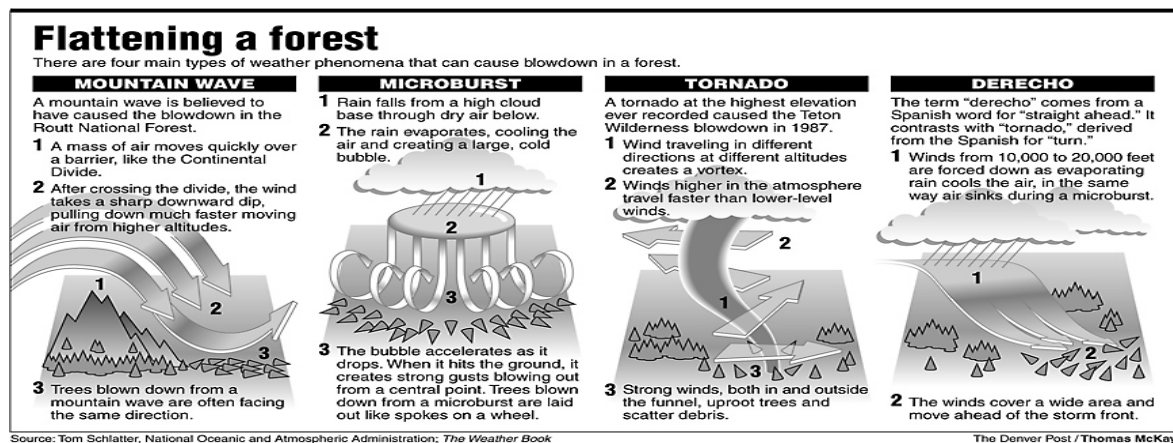
Front Row, left to right: Tom Eager, Susan Johnson, Bill Schaupp, Bob Averill, Michelle Frank, Jeri Lyn Harris
Back Row, left to right: Roy Mask, Erik Johnson, Kurt Allen, Bernard Benton, Dave Anderson, Dave Johnson,
Pete Angwin (currently with R-5, Redding CA.), Dave Crawford (Facilitator for coordination meeting, SJRG NF)
Not Pictured: Joel McMillin, Tom Juntti



Roadside camping area along forest road 400 to Slavonia. Trees at this site, and another 13,000 acres of the Medicine Bow – Routt National Forests, were heavily damaged by strong winds in Fall 1997. Picture taken by Robert Averill in the Summer of 1998.

Routt Divide Blowdown

On October 25, 1997, a unique weather phenomenon known as a "mountain wave" caused a "blowdown" of approximately 13,000 acres of trees in the Medicine Bow - Routt National Forest, near Steamboat Springs, Colorado. The weather event that caused the blowdown is termed "Mountain Wave" because of air dynamics and the interplay of mountain topography. Below is an illustration depicting the different types of weather phenomena capable of causing a blowdown:



"Blowdowns" are rare and create many new situations on the landscape both harmful and beneficial to life associated with the ecosystem. In this forest, the blowdown affected mostly mature spruce trees. The unusual event laid down the majority of trees west of the Continental Divide in an east-to-west orientation, opposite from the normal west-to-east wind flow. When weather experts analyzed the data, they saw that a unique wall of "mountain wave" clouds had set-up on the east rim of the 11,000 foot Continental Divide generating winds in excess of 120 m.p.h. These winds oriented down the west side of the slope. As a result of the powerful winds, trees snapped, laying uniformly across the landscape while others were uprooted, exposing the spruce trees' huge and extensive root system. Undoubtedly, one elk was killed; however, no evidence of dead, large wildlife was seen. Equally as surprising, hunters camping in the area of the blowdown survived the storm by taking refuge in a 60-year old cabin. The weather phenomenon that began around 3 a.m. and lasted approximately 3 hours, was part of a larger weather system moving across the northern part and Front Range of Colorado.

The implications of about 20 square miles of down timber necessitated that short- and long-term action to deal with the event had to be initiated. Human safety, wildlife habitat, spruce beetle habitat, 8,000 acres of blowdown located within the Mount Zirkel Wilderness and other considerations are some of the issues the Medicine Bow - Routt National Forest continues to contend with. In 1999, one final Environmental Impact Statement (EIS), the North Fork Salvage Analysis, one Draft Supplemental Environmental Impact Statement (DSEIS) to the North Fork Analysis, and two draft EIS, Upper Elk River Access and the South Fork Salvage Analysis have been completed.

The spruce beetle epidemics in Alaska on the Kenai Peninsula, in Utah on the Dixie and adjoining National Forests, and in the Flat Tops of Colorado on the White River National Forest, provide a glimpse of what may happen in the forest as the spruce beetle responds to an increase of host material. At this time, entomologists think the possibility of a spruce beetle outbreak occurring in the area of the Routt Divide Blowdown is high.

As a response to the Routt Divide Blowdown and the potential for increased activity by the spruce beetle, several actions were started by Forest Health Management staff in the Lakewood Service Center, the Regional Office and Routt National Forest to monitor and evaluate spruce beetle populations in and surrounding the blowdown. These activities include aerial surveys to detect recent tree mortality and blowdown, monitoring beetle flight using pheromone traps, conducting a spruce beetle extent survey, and conducting brood sampling to determine the status of spruce beetle in the blowdown.

Prior to the blowdown, aerial survey missions conducted on October 1-4, and 8-9, 1996, and August 6-8, 1997, indicated very low levels of spruce beetle activity on the Routt National Forest. Immediately following the blowdown event on October 29, 1997, Robert Averill and Erik Johnson flew an aerial survey mission. They sketchmapped the blowdown, but because of the time of year did not record tree mortality. On August 12, 13, and 18-21, 1998, another aerial survey mission was conducted over the Routt National Forest. Only two polygons of tree mortality were attributed to spruce beetle activity.

One set (2 traps) of pheromone traps was placed at the following seven sites: Lost Dog, Three Island Creek, Floyd Peak, Mad Creek, Buffalo Pass, Walton Creek and Dunckley Pass. Traps located at Walton Creek attracted spruce beetles and the beetles were caught for two successive weeks beginning July 6, 1998. Beetles were also caught at Dunckley Pass adjacent to blowdown that occurred in the Fall of 1996 as a result of a microburst weather phenomenon.

A survey to determine the extent of the infestation began on July 6, 1998. Spruce beetles were found in blowdown at Slavonia and Buffalo Pass the first week of the survey. By the first week of August, spruce beetles could be found in almost every piece of spruce blowdown examined. In September and October of 1998, more intensive surveys were conducted for presence or absence of spruce beetle in blowdown patches. An attempt was made to survey all mapped blowdown patches for evidence of spruce beetle brood production. Spruce beetles are common in blowdown: however, population levels at the time of the survey were sparse and not above expected levels for this situation. *Ips* spp. beetles were also found on the upper surfaces of blowdown trees. These beetles compete with spruce beetle for similar resources (Poland and Borden, 1998b; McCambridge and Knight, 1972). Generally, *Ips* spp. are not a problem as they will not move from the downed material to infest and kill standing green trees.

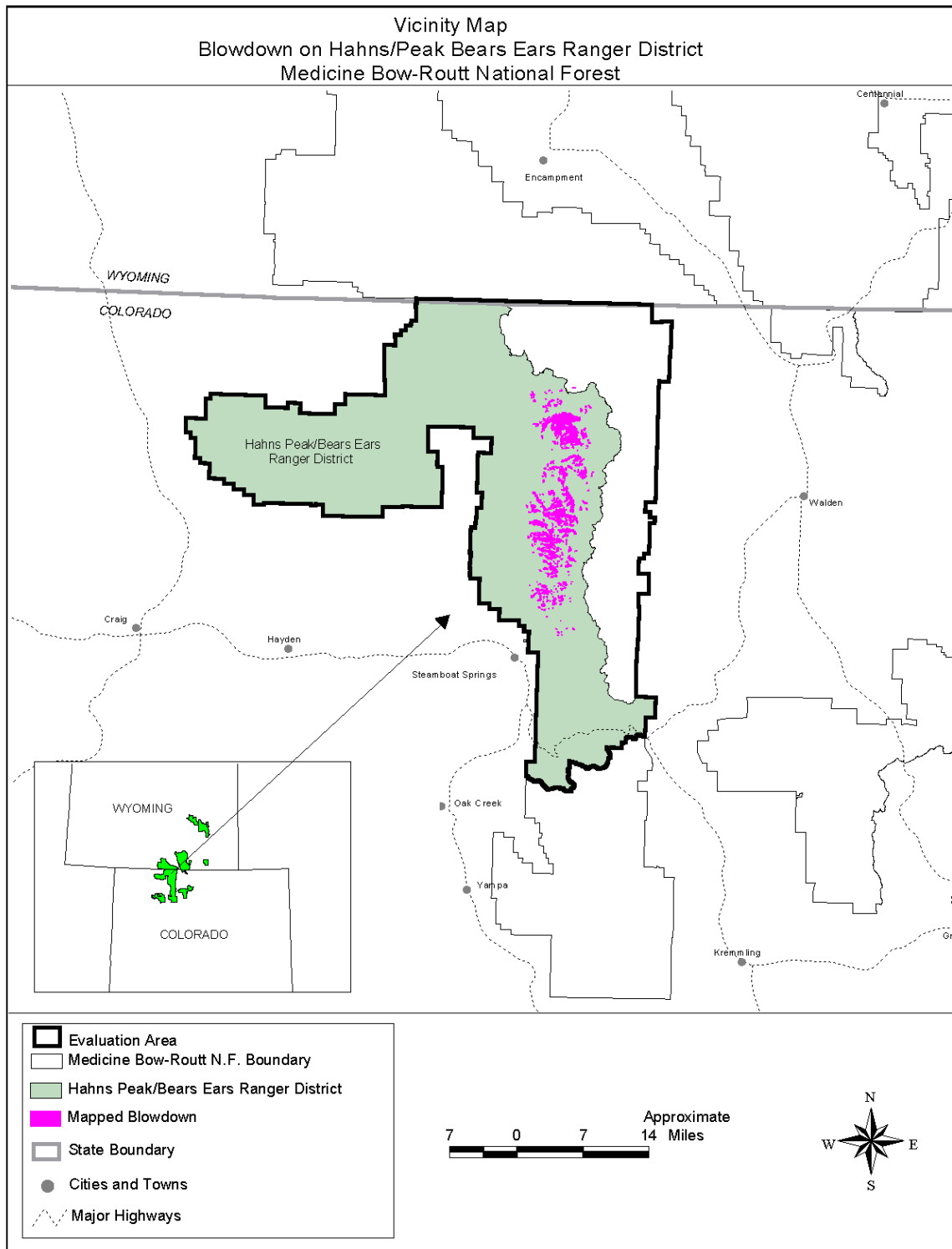
The latter part of September and the entire month of October, 1998, samples of spruce beetle brood were taken to determine the predominant life stages of spruce beetles present in the Routt Divide Blowdown. Brood densities were very sparse and most beetles were immature, requiring another year to complete development. However, some one-year old adult beetles were found in blowdown at Slavonia Trailhead, Lost Dog, Three Island and Mt. Warner areas. One-year life cycle spruce beetles were confirmed by finding callow adults at these locations.

During the 1999 field season, spruce beetle populations increased within and occupied more of the fallen spruce trees. Their populations were dense and could be found in almost every patch of blowdown surveyed. In addition, some beetles were maturing in one year instead of two.

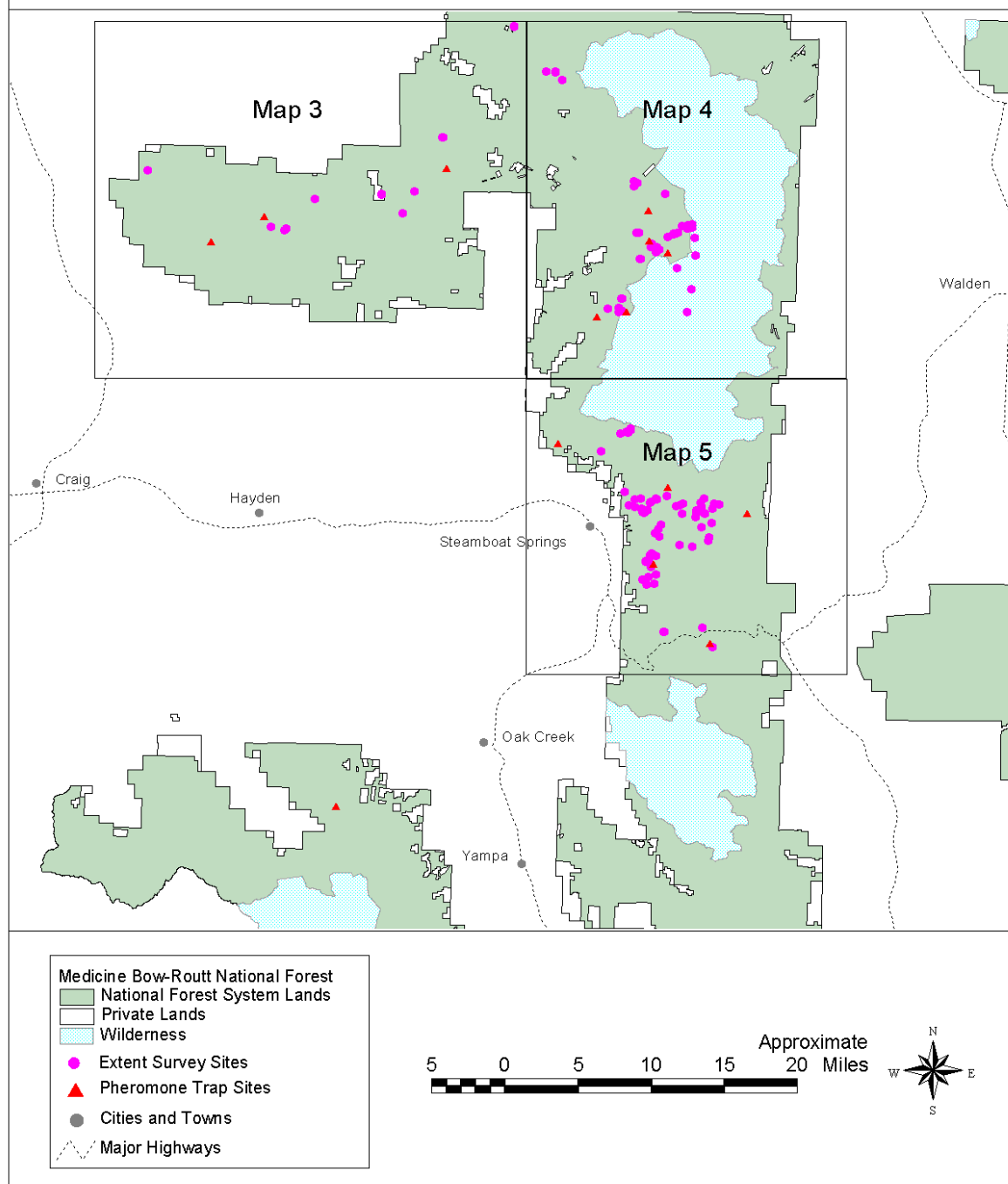
In 2000, spruce beetle populations are expected to begin to exit the windthrow and to attack the nearby forest, killing green spruce trees. The exact extent, intensity, and duration of such events cannot be predicted at present with absolute certainty. The eventual scale of these predicted events might cover one or more landscapes and result in significant spruce mortality and associated impacts.

Management efforts can locally mitigate spruce beetle impacts to varying degrees, but stopping a landscape-level spruce beetle epidemic once it has begun is almost impossible. In most cases large, spruce blowdowns, stopping a spruce beetle epidemic is nearly impossible due to the amount of unmapped, scattered blowdown and blowdown that is inaccessible. However, incipient epidemics can be controlled if proper suppression and prevention activities are initiated before these epidemics reach landscape proportions.





Location of 1999 Spruce Beetle Extent Surveys Medicine Bow-Routt National Forest



Forest Health Management Special Regional Projects – 1997-1999

Project Title: Insect/Disease and Hazard Tree Surveys in campgrounds and other recreational sites:

1997: Vallecito Campground (CG) – San Juan NF; Big Creek Lakes CG – Routt NF

1998: 2 CGs – Spearfish RD, Black Hills NF; 2 CGs – Nebraska NF; 9 CGs and 3 rec. sites of North Fork Shoshone – Shoshone NF

1999: 2 CGs – Nebraska NF; 8 campgrounds and 9 rec. sites – San Juan NF; 5 CGs – Grand Valley RD, GMUG NF

Investigators: Pete Angwin, Tom Eager, Jim Worrall, Bill Schaupp, Dave Johnson, Jeri Lyn Harris, Tom Juntti, Dan Long, Joel McMillin, and Kurt Allen, FHM.

Years: 1997 - 1999

Project Description: General Insect/Disease and hazard tree evaluations were performed for several campgrounds and other recreational sites (trailheads, overlooks, points of interest) around the Rocky Mountain Region. Defective trees were documented and extremely hazardous trees were reported to recreation managers of each national forest. Forest managers were encouraged to do complete, annual, documented surveys of the campgrounds. FHM training in hazard tree detection was done for the Pike National Forest in 1998 and the Shoshone National Forest in 1999.

Project Title: Pest Trend Impact Plots in the West-Rocky Mountain Region

Investigators: Pete Angwin, Jeri Lyn Harris, Tom Eager, Dave Johnson, and Bernard Benton, FHM

Cooperators: Judy Adams, FHTET; Jim Friedly, BIA Southern Ute Agency; Elizabeth Stiller, Phil Grumstrup, and Gary Say, Black Hills NF; Sam Schroeder, White River NF; Gary Roper, Mike Morrison and Mark Westfahl, Routt NF; Paul Langowski and Steve Johnson, Roosevelt NF; Jon Morrissey, Grand Mesa / Uncompahgre / Gunnison NF's; Phil Kemp and Bob Vermillion, San Juan NF; Dennis Eckhardt, Kim Barber, Karl Brauneis, Pat Heuer, Mark Hinschberger, and Roy Bergstrom, Shoshone NF; Chris Thomas, Bighorn NF; and Bill Hill, Custer State Park, South Dakota.

Years: Began 1991; end undetermined.

Project Description: Since 1991, Region 2 has been actively involved with the technology development project, "Pest Trend Impact Plots in the West". The objective of the project is to establish a series of permanent plots to provide data for the validation and calibration of various insect and disease computer simulation models. A second objective of these plots was to monitor the spread and impact of these diseases and insects.

Region 2 installed several plots to provide modeling and monitoring data. In 1997, dwarf mistletoe plots were established in Colorado and white pine blister rust plots were installed throughout Wyoming and South Dakota. In 1998, all of the root disease permanent plots throughout Colorado and South Dakota were re-measured, and more white pine blister rust plots were established in Wyoming. In 1997-1998, several subalpine fir decline plots were established in national forests in Colorado, Utah, and Wyoming to evaluate subalpine fir mortality caused by root disease and western balsam bark beetle.

Project Title: GIS - based Landscape Scale Root Disease Hazard Rating/Prediction System for Armillaria Root Disease in the Black Hills and Pinyon Pine Decline in southern Colorado.

Investigators: Jeri Lyn Harris, Dave Johnson, Michelle Frank, Pete Angwin, Tom Eager, and Roy Mask, FHM.

Cooperators: William Jacobi, Dept. of Plant Pathology, Colorado State University (CSU), Robin Reich and Gene Kelly of Dept. of Forestry, CSU, Melanie Kallas and Sam Harrison, Master of Science graduate students CSU; Jose Negron and John Lundquist, Rocky Mountain Forest and Range Experiment Station, USDA Forest Service. Eric Smith, Forest Health Technology Enterprise Team; John Guyon, Region 4, Forest Health Protection; Terry Rogers, Region 3, Forest Health Protection; Phil Kemp, Eric Lindroth, and Dan Greene, Dolores Ranger District, San Juan NF; Jim Friedley, BIA Southern Ute Agency; John Waconda, BIA Albuquerque Area Office; Dan Ochocki, Colorado State Forest Service, Durango District

Years: Began 1995; End 2002.

Project Description: Existing data on Armillaria root disease occurrence and new field data, were coupled with Natural Resource Conservation Service (NRCS) soil classification, stand inventory, site disturbance, habitat type, and meteorological data in a GIS database. Utilizing spatial statistical analysis, an Armillaria root disease hazard rating system was developed for the Black Hills National Forest and presented to forest managers in the Black Hills in 1998/1999.

Although a variety of causes are responsible for mortality of pinyon pine in various areas, in many locales the key agents are black stain root disease (*Leptographium wageneri*) and pinyon ips (*Ips confusus*). Using aerial photography and site visits by field personnel, mortality centers in pinyon pine on the San Juan National Forest and Southern Ute Indian Reservation will be located and entered into a GIS database along with soil and site characteristics and locations of disturbed areas. By analyzing the data using spatial statistics, a hazard rating system will be developed for pinyon pine decline in Southwest Colorado.

During the 1998 field season, conventional and digital color infrared aerial photographs were acquired in the study areas on the San Juan NF and Southern Ute Indian Reservation. Ground transects were run over a sample of mortality sites, where insect, disease, and site characteristics were recorded.

Project Title: Site and Stand Factors Associated with the Occurrence of Douglas-fir beetle in Douglas-fir

Investigators: Bill Schaupp, FHM, project leader; Jose Negron, USFS Rocky Mountain Research Station; Ken Gibson, USFS Region 1; Ralph Thier, Steve Munson, John Anhold, Dawn Hanson and others, USFS Region 4.

Cooperators: Biometrics Group, Rocky Mountain Research Station.

Years: Began 1992; End 1996. Product delivery ongoing.

Project Description: The objective was to evaluate characteristics of DFB infestations in Douglas-fir in order to develop an estimate of loss model. Such a model will allow classification of stands according to expected mortality from future DFB epidemics based on standard stand parameters such as basal area. This project was designed to provide a planning tool that can be used to prioritize proactive hazard mitigation efforts and to predict mortality from Douglas-fir beetle epidemics.

Products Available: A model was published in: "Probability of infestation and extent of mortality associated with Douglas-fir beetle in the Colorado Front Range" by Jose F. Negron, Forest Ecology and Management 107 (1998): 71-85. Copies are available from the project leader and the author.

Project Title: Alternatives to Fumigation for Nursery Diseases II.

Investigators: Mike Teberg and Jay Dunbar, Bessey Nursery; Jeri Lyn Harris, R2 FHM.

Cooperators: Robert James, Coeur d'Alene Nursery, USFS Region 1; Lucky Peak Nursery, USFS Region 4; Susan Frankel, Placerville Nursery, USFS Region 5; Diane Hildebrand, J. Herbert Stone Nursery, USFS Region 6; Michelle Cram, Toumey Nursery, USFS Region 8; Joe O'Brien and Jill Pokorny, Northeastern Area; Jenny Juzwik, USFS North Central Station; Raymond Allmaras, Agricultural Research Service, St. Paul; Neil Anderson and Cynthia Buschena, University of Minnesota; Badoura State Nursery, Minnesota; Griffith State Nursery, Wisconsin; Jeff Stone and Cynthia Ocamb, Oregon State University; Edward A. Hauss Nursery, Alabama Forestry Commission; Flint River Nursery, Georgia Forestry Commission; Clarence Lemons, Hendrix and Dale, Inc.; Stephan Fraedrich and David Dwinell, Southern Station; Scott Enebak, Auburn University.

Years: Begun 1998; End 2001.

Project Description: Building on the information learned from a previous nursery Technology Development Proposal (Alternatives to Fumigation, R6-93-01), nurseries in every Region (except 3 and 10) are participating in field comparisons of a variety of chemical and cultural treatments customized for each nursery. Four soil treatments are being compared at Bessey Nursery in Nebraska: methyl bromide fumigation, Basamid addition, solarization, and fallowing with tilling. Experimental blocks were treated with one of the above treatments and then planted with eastern redcedar. Soil samples were collected from each block before and after treatments and analyzed for the presence of pathogenic fungi and nematodes. As seedlings germinate and grow, the experimental blocks will be evaluated for quantity and quality of the seedlings in 1999 and 2000. Soil samples will be collected and evaluated each year.

Project Title: Monitoring and control projects of *Phomopsis juniperovora* at Bessey Nursery

Investigators: Jeri Lyn Harris and Dave Johnson.

Cooperators: Jay Dunbar and Mike Teberg, Bessey Nursery; Bob James, R1 FHP; Tom Landis, USDA Forest Service nursery specialist.

Years: Began 1997; End 2000.

Project Description: An epidemic of *Phomopsis* blight started building in 1997 due to heavy spring/summer rains. In 1998, the disease caused by *Phomopsis juniperovora* destroyed about 75% of the eastern redcedar Rocky Mountain juniper crops and in 1999 it caused 100% of the juniper crops to be unmarketable. Because of these destructive losses, FHM started weekly monitoring of "history" plots in the juniper nursery beds for early detection of the disease.

The juniper nursery beds and surrounding juniper shelterbelts were surveyed for *Phomopsis juniperovora* and cultures were collected for *in vitro* fungicide tests. Nursery managers were concerned that the local *Phomopsis juniperovora* had become resistant to their current fungicides. Several fungicides were tested with *Phomopsis juniperovora* isolates collected from Bessey Nursery. No resistance was found in these tests, but nursery managers were encouraged to use two or three different fungicides to acquire different modes of fungicide action on the juniper crops.

Project Title: The 5th Joint Meeting of the Western International Forest Disease Work Conference and Western Forest Insect Work Conference

Local Arrangements Chair: Dave Johnson.

Cooperators: Bill Jacobi, Colorado State University; Mike Schomaker and Dave Leatherman Colorado State Forest Service; Judy Adams, Forest Health Technology Enterprise Team; Jose Negron and John Lundquist, Rocky Mountain Research Station; and R2 Forest Health Management staff.

Years: 1999

Project Description: The 5th Joint Meeting of the Western International Forest Disease Work Conference and Western Forest Insect Work Conference was held in Breckenridge, Colorado on September 13-17, 1999. Plenary sessions were held on biological indicators of forest condition and insects/diseases in western forest disturbance regimes along with several insect/disease workshops and special paper presentations. There was a large poster session and an all-day field trip to Vail, CO and Dillon Reservoir. The meetings concluded with an evening banquet on Thursday evening and business meetings for both work conferences.

Rocky Mountain Region Insect and Disease

Status Report of 1997-1999

Common Name, Scientific Name: Mountain pine beetle, *Dendroctonus ponderosae*

State (s): Colorado, South Dakota, Wyoming

Host (s): Limber pine, Lodgepole pine, Ponderosa pine

Condition Description:

Colorado: Mountain pine beetle populations and associated pine mortality increased and expanded in Colorado each year. Statewide, estimated tree mortality from MPB was roughly 32,500 in 1997, 74,000 in 1998, to 150,000 in 1999.

Areas of significant activity included the Colorado Front Range, especially in the Cache la Poudre and South Platte River drainages and around Lake Granby, CO. On the southeastern edge of Wyoming's Sierra Madre Mountains and extending into the North Park of Colorado, several extensive areas of pine mortality were recorded. Mountain pine beetle activity in Vail Valley lodgepole pine and in the Upper Arkansas River Valley's ponderosa pine stands continued to expand rapidly. Large portions of the wildland-urban interface between Buena Vista and Salida have been impacted with ponderosa pine mortality as high as 80% in some stands. Beetle populations were on the rise throughout much of Colorado's ponderosa pine forests.

South Dakota: Populations continued to expand and damage increased in the Black Hills. Tree mortality increased from an estimated 5,200 trees in 1997 to 11,400 in 1998. Suppression activities are occurring in the Black Hills to try and minimize the situation.

In 1999, the mountain pine beetle populations in the Black Hills of South Dakota were expanding rapidly and moving distances of at least ¼ mile to infest new locations. The majority of the infestation was confined to National Forest lands, but greater impacts to private and state lands were anticipated in 2000. The water quality of the Sturgis watershed area could be threatened.

Wyoming: The eastern slope of the Bighorns contained approximately 800 ponderosa pine killed in 1997. In 1998 the number of trees killed along the eastern slope rose to approximately 1,500. In 1999, tree mortality increased to 2,200 trees killed. Approximately 1,200 limber pine over 377 acres were also killed. Some of these limber pine were thought have been infected by white pine blister rust.

Endemic levels of mountain pine beetle were found in lodgepole pine. There were low levels of tree mortality in lodgepole pine in the Shoshone National Forest. Roughly 600 whitebark or limber pines were reported killed by mountain pine beetle on the areas surveyed within the Shoshone National Forest in 1999.

Common Name, Scientific Name: Douglas-fir bark beetle, *Dendroctonus pseudotsugae*

State (s): Colorado, Wyoming

Host (s): Douglas-fir

Condition Description:

Colorado: In southwestern Colorado, Douglas-fir beetle impacted stands previously defoliated by western spruce budworm, *Choristoneura occidentalis*. Beetles were also present in large numbers in trees scorched during spring prescribed fire events. An infestation of several hundred trees was detected just west of Oak Creek, Colorado. Light Douglas-fir beetle activity continues in the San Juans, north of Durango in approximately 1,700 trees. Two epidemics continued in the South Platte River drainage, one spawned by the Buffalo Creek fire of 1996 and the other following the Douglas-fir tussock moth outbreak of 1993-1995.

In 1999, Douglas-fir beetle activity was evident on the Saguache RD of the Rio Grande NF, where Douglas-fir forests have been repeatedly defoliated by western spruce budworm for the past 13 years. Activity was also detected in the Dallas Divide area and just west of Vallecito Reservoir. State lands, primarily in Fremont county, saw an increase in Douglas-fir beetle during 1999. There are roughly 5000 acres (mostly on steep slopes) that are considered susceptible to Douglas-fir beetle. Mortality has increased by 32% from 1998 estimates. Almost three quarters of Colorado's total Douglas-fir beetle mortality occurred within the lower South Platte River watershed. Douglas-fir beetle also continues to kill trees that survived the 1996 Buffalo Creek Fire. Mortality elsewhere along the Colorado Front Range continues in small, widely scattered groups.

Wyoming: Douglas-fir beetle populations declined in the Sunlight Basin area of the Shoshone NF, however, there were over 600 trees killed along the North Fork of the Shoshone River corridor. Douglas-fir beetle killed 1,700 trees on 2,383 acres along the North Fork of the Shoshone River in the Shoshone National Forest. This increased to 14,500 trees on 5,791 acres in 1999. Douglas-fir beetle continues to remain at endemic levels in the Bighorn National Forest in Wyoming.

Common Name, Scientific Name: Spruce beetle, *Dendroctonus rufipennis*

State (s): Colorado, Wyoming

Host (s): Engelmann spruce

Condition Description:

An extensive survey in the Routt Divide Blowdown which took place in October, 1997, in north central Colorado and south central Wyoming detected spruce beetle populations in windthrow at nearly every survey location. Brood sampling and casual observations showed that spruce beetle densities in windthrow were very low, but that some of the population would mature in only one season. No attacks on standing trees were detected. Intensive monitoring and sampling continued to monitor the expected mortality of standing trees surrounding the 13,000 acres of windthrow.

Low numbers of spruce beetles have responded to approximately 600 acres of windthrown spruce on the Rio Grande NF near Creede, CO. Salvage operations are complete. Windstorms in late 1997 generated large amounts of windthrow scattered throughout the spruce/fir type. Much of this is in inaccessible areas.

In 1999, spruce beetle populations in Colorado were building in Conejos, Garfield and Eagle counties. In Wyoming, spruce beetle damage was severe in many side drainages of the North and South Forks of the Shoshone River. An estimated 15,000 trees were killed on 5,523 acres. A build up of spruce beetle populations was expected for the Snowy Range of south-central Wyoming in 2000. This area experienced recent windthrow (1997-'98) in the spruce cover type.

Common Name, Scientific Name:	Engraver beetle, <i>Ips</i> spp.
State (s):	Colorado, Nebraska, South Dakota, Wyoming
Host (s):	Black Hills spruce, Jack pine, Lodgepole pine, Ponderosa pine
Condition Description:	Ips beetles caused scattered mortality throughout the Region. Significant activity was usually correlated with damage to host trees by windthrow or fire. For the most part, Ips activity was reduced once the predisposed hosts were killed or otherwise removed. Populations in pine were very limited with no economic damage reported. However, single and small groups of ponderosa pine trees were killed on the Nebraska NF, and the Pine Ridge and Rosebud Indian Reservations in SD. Additional Ips activity was observed on jack pine that had been previously defoliated by jack pine budworm on the Nebraska National Forest. Activity increased on spruce trees in the Black Hills, affecting some scenic areas and campgrounds. In Colorado, activity by more than one species was reported in ponderosa pine in Jefferson and Douglas Counties and was associated with nearby construction sites.

Common Name, Scientific Name:	Douglas-fir tussock moth, <i>Orgyia pseudotsugata</i>
State (s):	Colorado
Host (s):	Douglas-fir
Condition Description:	The Colorado early warning system using pheromone traps captured very few moths, predicting no population increase in 1996. As the 1993 - 1995 Douglas-fir tussock moth outbreak subsided, the Douglas-fir beetle populations increased dramatically; elevated beetle populations continued to kill trees near Deckers and Sprucewood, Colorado

Common Name, Scientific Name:	Jack pine budworm, <i>Choristoneura pinus</i>
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State (s): Nebraska

Host (s): Jack pine

Condition Description:

An 1997 outbreak of jack pine budworm on the Nebraska NF continued during 1998. There was extensive defoliation in the jack pine plantations on the forest.

Common Name, Scientific Name:

Western spruce budworm, *Choristoneura occidentalis*

State (s): Colorado, Wyoming

Host (s): Douglas-fir, Engelmann spruce, Blue spruce, True fir

Condition Description:

In 1998, heavy defoliation was evident in Douglas-fir along the Lake Fork of the Gunnison River and immediately surrounding Lake City, CO. Western spruce budworm populations remained at moderate levels throughout portions of the Rio Grande and San Juan NFs in southern Colorado. In the northern San Juan Mountains near Ouray, over 4,000 acres of western spruce budworm defoliation in subalpine fir and Englemann spruce was detected. Western spruce budworm was also detected along the eastern slope of the northern Sangre de Cristo Mountains. In Wyoming, no noticeable activity was reported.

In 1999, an estimated 41,000 acres of forest was defoliated by western spruce budworm in southwestern Colorado. This approximately doubled the number of acres defoliated in 1998. Most of the western spruce budworm activity occurred throughout the Sangre de Cristo and Wet Mountains in Costilla, Custer, Fremont, Las Animas, and Saguache counties. Defoliation of Douglas-fir in Hinsdale County, adjacent to Lake City, CO, was less severe than that observed in 1998.

Common Name, Scientific Name:

Gypsy moth, *Lymantria dispar*
(Non-native)

State (s): Colorado, Kansas, Nebraska, South Dakota, Wyoming

Host (s): Hardwoods

Condition Description:

1997: Several traps were placed in the field on National forests and other federally managed lands in the Rocky Mountain Region. Two moths were found in traps at F.E. Warren Air Force Base in Cheyenne, Wyoming; delimitation surveys will be conducted in these areas in 1998.

1998: In Colorado, approximately 1,800 detection traps caught six moths, one per trap, in the following Counties: Adams, Boulder (2), El Paso (2), and Larimer. Two delimitation efforts around 1997 capture sites were negative. In Kansas, 639 detection traps caught no gypsy moths. In Wyoming, four moths were captured. Two detection traps captured one moth each in

Laramie County, WY, and one moth was captured in Yellowstone National Park. The delimitation effort in Cody was negative. Delimitation traps on Warren Air Force Base in Cheyenne captured one moth; this is the third consecutive year of delimitation captures on the Base. Four moths were caught in South Dakota, 3 in the Black Hills area and one in Sioux Falls.

1999: A total of 11 moths (all singles) were caught in Colorado. The Colorado State Forest Service put out a total of 972 detection traps. The 1999 catches were in Rocky Mountain National Park (in a delimitation trap near the 1998 catch), Castle Rock (south of the Denver Metro area), and 9 scattered about the Denver Metro area in Jefferson and Arapahoe counties.

In Kansas, several dozen traps were placed at locations across the state as a cooperative effort by state and federal agencies. No moths were caught in 1999 traps. However, Kansas Department of Agriculture found three egg masses on Christmas trees imported from Michigan. None of the egg masses were viable.

Trapping throughout South Dakota resulted in catching 4 male moths. One moth was on the eastern border and 3 were in private campgrounds in the Black Hills. The catches are attributed to movement of tourists from infested areas.

Six adult-male gypsy moths were captured in Wyoming during 1999. One moth was captured in both Park and Lincoln counties and four moths were captured in Washakie county. F.E. Warren Air Force Base in Cheyenne had multiple catches in 1996, 1997, and 1998. No moths were found in 1999.

Common Name, Scientific Name:

Asian long-horned beetle, *Anoplophora glabripennis*
(Non-native)

State (s):

Region 2: Colorado, Kansas

Host(s):

Condition Description:

Surveys were conducted by Kansas Department of Agriculture for evidence of this pest since dead larvae were found in pallets from China in 1998. Surveys were conducted at businesses that deal in pallets and at any other locations where pallets were found. Also, trees around areas with pallets were surveyed for signs of infestation. No indication of Asian long-horned beetles was found.

Common Name, Scientific Name:

Dwarf mistletoe, *Arceuthobium americanum*

State (s):

Colorado, Wyoming

Host (s):

Lodgepole pine

Condition Description:

Dwarf mistletoes cause the greatest disease losses in Region 2. Forest Health Management funded multiple surveys and

suppression projects on National Forests. Continued emphasis was being placed on surveys at landscape scale and on smaller-scale, suppression projects in developed recreation sites.

Lodgepole pine dwarf mistletoe is common in the Shoshone National Forest with the majority located at the southern end of the Wind River and Washakie Ranger Districts. This continues to be a problem on State lands in the Green Mountains of Fremont County. There are roughly 5000 acres of lodgepole pine infested with dwarf mistletoe in the Green Mountains.

Common Name, Scientific Name: Dwarf mistletoe, *Arceuthobium vaginatum subsp. cryptopodum*

State (s): Colorado

Host (s): Ponderosa pine

Condition Description: As populations of the mountain pine beetle increase along the Colorado Front Range, the health of ponderosa pine stands is a concern. Dwarf mistletoe infests about 20% of stands along the Front Range; these stands may be more susceptible to beetle attack as a result. In 1998, mountain pine beetle populations were expanding in many parts of Colorado and together with the presence of dwarf mistletoes, complicating managers' abilities to meet certain resource management goals.

Common Name, Scientific Name: Dwarf mistletoe, *Arceuthobium douglasii*

State (s): Colorado

Host (s): Douglas-fir

Condition Description: Occurs mostly in the southern two-thirds of Colorado.

Common Name, Scientific Name: Armillaria root disease, *Armillaria* spp.

State (s): Colorado, South Dakota, Wyoming

Host (s): Engelmann spruce, Colorado blue spruce, Hardwoods, Lodgepole pine, Ponderosa pine, Douglas-fir, Subalpine fir, White fir

Condition Description: Armillaria, the most common root disease in the Region, was evident in the mixed conifer and spruce-fir cover types. Armillaria was among the key causal agents contributing to subalpine fir decline, which accounts for the most tree mortality in spruce-fir cover types in the Rocky Mountain Region. Armillaria incidence in developed recreation sites in Colorado resulted in tree failures and numerous tree removal projects.

Although no acreages are available, Armillaria is building up in northeast Wyoming (Crook and Weston counties). Permanent plots were established in 1991 to assess the role of this and other root diseases.

Common Name, Scientific Name: Annosus root disease, *Heterobasidion annosum*

State (s): Colorado, Nebraska

Host (s): Ponderosa pine, White fir, Jack pine

Condition Description:

Annosus root disease has scattered distribution in white fir in the mixed conifer type throughout southern Colorado. In campgrounds, the disease creates hazardous conditions by increasing the probability of tree failure.

Common Name, Scientific Name: Black Stain root disease, *Leptographium wagneri*

State (s): Colorado

Host (s): Pinyon pine

Condition Description:

Black stain in combination with other factors caused widespread pinyon mortality in southwestern Colorado. This area experienced unprecedented development pressure and may be compounding the problem. Black stain has not been identified east of the Continental Divide in Colorado pinyon forests. A cooperative effort with CSU was initiated to assess this phenomenon on a landscape scale.

Common Name, Scientific Name: White pine blister rust, *Cronartium ribicola*

State (s): Colorado, Wyoming

Host (s): Limber pine, White pine

Condition Description:

This disease was found for the first time on the Roosevelt NF in northern Colorado on limber pine in 1998. The rust caused branch and main stem cankers but incidence appeared low. White pine blister rust occurs at low to moderate infection levels in whitebark and limber pine stands in South Dakota and Wyoming. A few stands have higher levels with more than 50% of the trees infected and causing some mortality. Within the areas surveyed, roughly 6,260 acres of the Shoshone National Forest were severely impacted by white pine blister rust. White pine blister rust impacted 428 acres in the Bighorn National Forest within the areas surveyed.

Common Name, Scientific Name: Juniper blight, *Phomopsis juniperovora*

State (s): Nebraska

Host (s): Rocky Mtn. Juniper, Eastern redcedar

Condition Description:

This disease usually occurs at low infection levels throughout the Rocky Mountain Region. However, at Bessey Nursery in Nebraska, the disease caused a 75% crop loss of juniper for 1998, and 100% loss in the juniper crop 1999. Kansas nurseries had fewer disease problems than in recent years due to a very dry summer.

Common Name, Scientific Name: Oak wilt, *Ceratocystis fagacaerum*

State (s): Kansas, Nebraska

Host (s): Oak species

Condition Description:

Oak wilt was a problem in isolated areas of northeast Kansas, but numbers of reports were lower in 1998. The disease continues to be a problem in forests along the eastern edge of the state of Nebraska.

Common Name, Scientific Name: Dutch elm disease, *Ceratocystis ulmi*

State (s): Colorado, Kansas, Nebraska, South Dakota

Host (s): Elm species

Condition Description:

This disease was a serious problem in many Kansas urban areas. Reports of the disease were on the increase for the past several years. Dutch elm disease continued to be a problem in riparian areas and cities throughout Nebraska. In Colorado, the disease did not cause major problems anywhere in the state, although losses were taken seriously by the respective towns or private citizens that own elm trees. Sytematic surveys continued to be conducted by Colorado State Forest Service Districts.

Common Name, Scientific Name: Subalpine fir decline (Western balsam bark beetle, *Dryocoetes confuses*; *Armillaria ostoyae*)

State (s): Colorado, Wyoming

Host (s): Subalpine fir

Condition Description:

Subalpine fir mortality was common in the spruce/fir cover type of Colorado due to a complex of factors that as yet are not well understood. Factors in addition to western balsam bark beetle

include Armillaria root disease and possibly other biotic and abiotic influences that collectively are referred to as 'subalpine fir decline'. Mortality estimates were complicated by the fact that dead subalpine fir retains its needles longer than other conifer species. Levels of mortality vary greatly, with some stands losing a significant proportion of the fir component over the course of several years. The fact that site specific root disease (*Armillaria* spp.) was involved indicated that the problem did not disappear, but manifests itself from year to year depending upon climatic conditions and population changes in associated insects.

Subalpine fir decline was the most widespread damage agent detected in the region in 1999. In Wyoming, a total of 4,600 trees on 2,805 acres were affected by SAF decline in surveyed areas of the Shoshone National Forest.

Common Name, Scientific Name: Pinyon pine decline

State (s): Colorado

Host (s): Pinyon pine

Condition Description:

Pinyon mortality of undetermined cause continued along the Arkansas River near Buena Vista, CO. Unlike extreme southwestern Colorado, neither blackstain nor *Ips* spp. beetles were contributing to the observed mortality.

Common Name, Scientific Name: Chemical Damage

State (s): Colorado, Kansas, Nebraska, South Dakota, Wyoming

Host (s): All Species

Condition Description:

With increasing population growth and development in Colorado, road maintenance is necessary for public safety. Increased number of inquiries were received concerning damage along roadsides due to the application of deicing salts, dust abatement chemicals, and mechanical damage by snowplows. Herbicide damage to windbreaks and other tree plantings continued to be a serious problem in the central portion of Kansas. Pesticide drift off targeted areas in crop weed control programs caused noticeable damage in parts of Kansas.

Common Name, Scientific Name: Weather Damage

State (s): Colorado, Kansas, Nebraska, South Dakota, Wyoming

Host (s): All Species

Condition Description:

By early summer 1998, ponderosa pines throughout much of the San Juan NF (from 6500 to 9000 ft. in elevation) experienced

discolored needles. Discoloration was not always limited to older needles. No biotic cause was identified and the widespread occurrence of the discoloration appeared to be of weather origin. Discoloration was observed again in Spring 1999.

In 1999, approximately 3000 acres of wind damage occurred in the higher elevations of the White River National Forest in Colorado. This blowdown contributed to an increase of spruce beetle populations in the area. Other areas of concern included the San Juan and Routt National Forests where past blowdown events created suitable breeding habitat for spruce beetle. There were isolated patches of wind thrown Engelmann spruce in the Snowy Range of the Medicine Bow National Forest in Wyoming.

Other Insects and Diseases of Concern

Insect Activity

ORGANISM	HOST and LOCATION	REMARKS
Bronze birch borer <i>Agrilus anxius</i>	Paper birch NE, SD, WY	No significant activity reported.
Bagworm <i>Oiketicus</i> spp. <i>Thyridopteryx</i> spp.	Eastern redcedar, Rocky mountain juniper KS	After 3 years of heavy damage, the bagworm population moderated
Cankerworms <i>Alsophila pometaria</i> <i>Paleacrita vernata</i>	Bur oak, Elm, Green ash, Hackberry, Honeylocust KS, SD, WY	Damage was light in KS in 1998.
Chafer <i>Diplotuxis obscura</i>	Ponderosa pine CO	No significant activity reported.
Common pine shoot beetle <i>Tomicus piniperda</i>	Scotch pine, White pine KS	Not reported in Kansas, where semiochemical trap results were negative.
Dioryctria pine moths <i>Dioryctria</i> sp.	Austrian pine, Pinyon pine, Ponderosa pine, Scotch pine CO, NE, SD	Populations appeared to be down from 1997, however, there were areas of heavy damage in the Nebraska NF.
Elm leaf beetle <i>Xanthogaleruca luteola</i>	American elm, Siberian elm CO, KS, NE, SD	Damage was unusually light in Kansas.
European pine sawfly <i>Neodiprion sertifer</i>	Scotch pine KS, NE, SD	Reports of damage were quite common from Christmas tree growers in eastern Kansas.
Fall webworm <i>Hyphantria cunea</i>	Cottonwood, Walnut, Hickory, Mulberry CO, KS, SD, WY	In Kansas, first generation populations were very common, while second generation populations were low.
Green striped maple worm <i>Dryocampa rubicunda</i>	Silver maple KS	No significant activity reported.
Hackberry caterpillar <i>Asterocampa celtis</i>	Hackberry KS	Populations were light in 1998.

Imported Honeysuckle aphid <i>Hyadaphis tataricae</i>	Tatarian honeysuckle KS, SD	In Kansas, populations were light to heavy. Tatarian honeysuckle is seldom planted in windbreaks now due to this very serious insect pest.
Juniper sawfly <i>Monoctenus fulvus</i>	Eastern redcedar, Rocky Mountain juniper KS	Populations in Kansas were light.
Lilac borer <i>Podosesia syringae</i>	Green ash KS	Sporadic reports from Kansas ranged from light to heavy. This very common pest limits the use of green ash in windbreaks to very fertile, moist sites.
Loblolly pine sawfly <i>Neodiprion taedae</i>	Austrian pine, Ponderosa pine Kansas	Light damage appeared restricted to three northwest counties. This insect species is expected to move south and east into Kansas and will be monitored.
Oak leaf roller <i>Tortricidae</i>	Gambel Oak CO	The oak leaf roller defoliated large acreages of Gambel oak over large areas of Colorado. Outbreaks occurred spontaneously in widely separated locales on both sides of the Continental Divide. Most of the defoliation occurred in the late spring and most of the affected oaks were able to produce a second flush of leaves, which escaped defoliation. The widespread defoliation was a previously unrecorded phenomenon and it was unknown if the defoliation will re-occur. Approximately 43,254 acres were affected.
Pine butterfly <i>Neophasia menapia</i>	Ponderosa pine SD	Very light and scattered in the Black Hills
Pine needle miner	Scotch pine KS	Common in northeast Kansas. The damaging agent is not yet identified and may be either a pine needle miner or one or more pine tip moth species. Economic importance is limited to Christmas tree plantations.
Pine needle scale <i>Chionaspis pinifolia</i>	Austrian pine, ponderosa pine, Scotch pine KS	Damage increased this year to an overall moderate level ranging from light to heavy.

Pine sawflies <i>Neodiprion autumnalis</i> , <i>Neodiprion fulviceps</i>	Ponderosa pine CO, SD, WY	Only very light and scattered populations in South Dakota and Wyoming.
Pine tip moths <i>Rhyacionia bushnelli</i> , <i>Rhyacionia frustrana</i> , <i>Rhyacionia neomexicana</i>	Austrian pine, Ponderosa pine, Scotch pine, Virginia pine CO, NE, KS, SD, WY	In Kansas, Nantucket pine tip moth (<i>R. frustrana</i>) damage was light to moderate. It may be that two or more pine tip moth species are present in Kansas because chemical control is becoming more complex and applications more frequent due to overlapping generations. Pine tip moths are currently the worst economic forest insect pests in Kansas. Populations appeared to be down from 1997.
Pine tussock moth <i>Dasychira grisefacta</i>	Ponderosa pine CO, NE, SD, WY	No significant activity reported.
Pine tortoise scale <i>Tourmeyella parvicornis</i>	Austrian, red, Scotch pines Kansas	Populations increased this year. Heavy populations were reported in Butler County. This insect is very common in northeastern Kansas and probably occurs statewide.
Red turpentine beetle <i>Dendroctonus valens</i>	Jack pine, Ponderosa pine NE, SD, WY	No noticeable activity.
Spruce needleminer <i>Endothenia albolineana</i>	Blue spruce South Dakota	No significant activity reported.
Smaller European elm bark beetle <i>Scolytus multistriatus</i>	Elm CO	No significant activity reported. See Dutch Elm Disease.
Southern pine engraver <i>Ips grandicollis</i>	Scotch pine KS	The large population increase this year may be due to tree stress from high temperatures and wind in May.
Tent caterpillars <i>Malacosoma americanum</i> <i>M. californicum</i>	American plum, Aspen, Chokecherry, Hardwoods	Populations generally appeared to be lower than in 1997 across SD, WY, and NE.

<i>M. disstria</i>	CO, KS, SD, WY	
Twig beetles Pityophthorus spp. Pityogenes spp.	Pinyon pine, Ponderosa pine CO	Large numbers of twig beetles were evident in pinyon stands south of Montrose, CO. Large clearings and resulting untreated slash piles may be contributing factors. Urbanization of the pinyon juniper forests is creating stresses not previously documented in this cover type.
Walnut caterpillar <i>Datana integerrima</i>	Black walnut, Bur oak, Hickory, Pecan KS, NE	Damage was light in Kansas.
Walnut trunk webbing caterpillar <i>Gretchena concitaticana</i>	Walnut KS	Larval populations and leaf damage were low. The populations were not sufficient to cause any webbing on tree trunks. Little is known of the population dynamics or long-term host impacts of this insect.
Western pine beetle <i>Dendroctonus brevicornis</i>	Ponderosa pine CO	No significant activity reported.
Yellownecked caterpillar <i>Datana ministra</i>	Oaks, Basswood, Elm, Fragrant sumac, Maple KS	Damage was below normal and populations were not large enough to cause complete tree defoliation.
Zimmerman pine tip moth <i>Dioryctria ponderosae</i>	Austrian pine, ponderosa pine KS	Damage to a few northwestern windbreaks continues to be reported, but its occurrence was down this year. This item also covers the activity of the pine pitch moth, <i>Synanthedon pine</i> .

Disease Activity

STEM AND BRANCH DISEASES		
Black knot <i>Apiosporina morbosum</i>	Chokecherry CO, SD	Damages by this disease increased on chokecherry in riparian zones on the Black Hills due to increased spring precipitation in 1997 and 1998.
Comandra blister rust <i>Cronartium comandrae</i>	Lodgepole pine, Ponderosa pine CO, SD, WY	This disease continues as one of the most common diseases of lodgepole pine in northern Colorado, western South Dakota and Wyoming, but is of concern in only a few areas.

Elytroderma needlecast <i>Elytroderma deformans</i>	Ponderosa pine SD	This disease caused damage in many new areas of the Black Hills. The disease was able to increase in intensity due to increased spring precipitation in 1997 and 1998.
Fir broom rust <i>Melampsorella caryophyllacearum</i>	Subalpine fir CO, WY	This disease is common throughout the spruce/fir cover type in Colorado and south central Wyoming where it causes only minor damage.
Fire blight <i>Erwinia amylovora</i>	Apple species, Cotoneaster, Crabapple CO, SD, WY	No significant activity reported.
Pine tip blight <i>Sphaeropsis sapinea</i>	Austrian pine, Ponderosa pine KS	A major threat to Austrian pine in the eastern two-thirds of Kansas. Ponderosa pine appears to be more tolerant of the disease.
Spruce broom rust <i>Chrysomyxa arctostaphyli</i>	Blue spruce, Engelmann spruce, White spruce CO	Common throughout the spruce/fir type in Colorado where it generally causes only minor damage.
Western gall rust <i>Endocronartium harknessii</i>	Lodgepole pine, Ponderosa pine CO, NE, SD, WY	Found in several locations in Kansas on ponderosa pine.
CANKER DISEASES		
Black target canker <i>Ceratocystis fimbriata</i>	Aspen CO	The most common canker disease of aspen in Colorado. It is mainly a concern in developed recreation sites.
Cytospora canker <i>Cytospora</i> spp. <i>Leucocytospora</i> spp.	Aspen, Cottonwood, Poplar, Spruce, Willow CO, KS, NE, SD, WY	This disease is common on aspen.
Cryptosphaeria canker <i>Cryptosphaeria populina</i>	Aspen CO, SK	Common in many aspen stands throughout Colorado.
Russian Olive canker <i>Phomopsis arnoldiae</i> <i>Tubercularia</i> spp. <i>Lasiodiplodia</i> spp.	Russian olive KS, NE, SK, WY	Continues to be a very serious problem in the eastern half of Kansas and Russian Olive is no longer recommended for use in conservation plantings.

Siberian elm canker <i>Botryodiplodia hypoderma</i> <i>Tubercularia ulmea</i>	Siberian elm CO, NE, SD, WY	No significant activity reported.
Sooty bark canker <i>Encoelia pruinosa</i>	Aspen CO CO	Common in aspen stands in CO
Thyronectria canker <i>Thyronectria austro-america</i>	Honeylocust CO, KS, NE	Appears to be increasing statewide in KS in windbreaks and landscape trees.
DWARF MISTLETOES		
<i>Arceuthobium cyanocarpum</i>	Limber pine CO, WY	Commonly occur in sites with significant amounts of the host trees.
<i>Arceuthobium divaricatum</i>	Pinyon pine CO	
DECAYS AND ROOT DISEASES		
Aspen trunk rot <i>Phellinus tremulae</i>	Aspen CO, SD	Common throughout Colorado aspen stands.
Red ray rot <i>Dichomitus squalens</i>	Ponderosa pine SD	No significant activity reported
White mottled rot <i>Ganoderma applanatum</i>	Aspen CO	No significant activity reported
Black stain root disease <i>Leptographium wagneri</i> , <i>L. terebrantis</i>	Pinyon pine, Ponderosa pine CO, NE	Black stain in combination with other factors has caused widespread pinyon mortality in southwestern Colorado. This area is experiencing unprecedented development pressure which may be compounding the problem. A cooperative effort with CSU has been initiated to assess this phenomenon on a landscape scale.
FOLIAGE DISEASES		
Anthraxnose <i>Gnomonia</i> spp. <i>Discula</i> spp. <i>Gnomoniella fraxini</i>	Walnut, Ash, Maple, Sycamore CO, KS, NE, SD, WY	A recurring problem on several hardwood species in Kansas. Reported as heavy.

Aspen leaf blights <i>Ciborina whetzellii</i> <i>Marssonina populi</i>	Aspen CO, SD	Foliage diseases were rare since much of the spring and summer was dry. Presence of Marssonina in aspen declined significantly following two years of widespread impact in southwestern CO.
Brown spot needle blight <i>Scirrhia acicola</i> <i>Mycosphaerella dearnessii</i>	Scotch pine KS, NE	Continues as a serious threat to Christmas tree plantations in KS. Growers continue to remove and destroy many heavily infected trees.
Cedar apple rust <i>Gymnosporangium juniperi-virginiana</i>	Apple species, Eastern redcedar, Rocky Mtn. juniper, Utah juniper CO, KS, NE, SD, WY	A serious economic pest in some fruit orchards. Moderate to heavy infection reported this last year.
Juniper Rust <i>Gymnosporangium nelsonnii</i>	Rocky Mtn. juniper, Serviceberry CO	No significant activity was reported.
Cercospora blight of juniper <i>Cercospora sequoiae</i>	Eastern redcedar, Rocky Mtn. juniper KS, NE, SD	A severe problem on Rocky Mtn. juniper in eastern Kansas. It is recommended that this species not be planted in these areas.
Conifer-aspen rust <i>Melampsora medusae</i>	Aspen, Douglas-fir, lodgepole pine, ponderosa pine CO, NE, SD	No significant activity was reported.
Diplodia blight <i>Sphaeropsis sapinea</i>	Ponderosa pine, lodgepole pine KS, NE, SD, WY	Significant damage and possible future mortality by this disease were found on over 2000 acres during aerial survey flights of NE. The NE, NF, and the Pine Ridge and Rosebud IR.
Dothistroma needle blight <i>Dothistroma pini</i> <i>Mycosphaerella pini</i>	Austrian pine, ponderosa pine Limber pine KS, NE, WY	Damage was reported as light to heavy in the eastern half of Kansas and timely pesticide applications are needed to control the disease.
Melampsora leaf rusts <i>Melampsora</i> spp.	Aspen, Cottonwood, Willow CO, KS	No significant activity was reported.
Needle casts <i>Lophodermella concolor</i> <i>L. montivaga</i>	Lodgepole pine CO, WY	No significant activity was reported.

<i>L. cerina</i>	Ponderosa pine CO	No significant activity was reported.
VASCULAR WILTS		
Ash yellows Caused by phytoplasmas	Green ash, white ash CO, KS, NE, SD, WY	No significant activity was reported.
Pinewood nematode <i>Bursaphelenchus xylophilus</i>	Austrian pine, Scotch pine, white pine KS, NE, SD	The range of this disease has moved west in Kansas. A serious problem in the eastern portion of Kansas and Wichita, KS. Confirmed on Scotch pine and eastern white pine.
ABIOTIC		
Drought and other agents	Black walnut, blue spruce, buffalo berry, dogwood, green ash, pear, ponderosa pine, poplar, Russian olive, Siberian elm, silver maple CO, NE, KS, SD, WY	Pinyon pine has been declining in the Buena Vista, CO area for about 5 years. No pathogen or insect appears to be related to this damage. Droughty winters and warm, dry summers may be involved.
Flooding/Heavy Rains/ Saturated soils	Hard and softwood species CO, KS, NE, SD, WY	No significant activity was reported.
Winter/hail damage	Hard and softwood species CO, KS	No significant activity was reported.

1997-1999 Aerial Survey

Aerial surveys have been utilized for the detection of forest insect and disease activity within this Region since the early 1950's. By flying at relatively low altitudes in a fixed-wing aircraft, it is possible to assess and map many different types of insect and disease damage. Aerial detection survey information is not as precise as aerial photography, or ground surveys, but is the most cost efficient method to meet the intended purposes. The general survey performed each year throughout the region to detect new outbreaks and monitor outbreaks currently in progress has been dubbed the "overview survey".

Overview surveys for damage and mortality in forest stands due to insects, diseases and other forest disturbances are typically flown throughout Region 2 between late June and early October cooperatively by personnel from the USDA Forest Service, state forestry agencies, and the US Department of Defense. In addition to the overview survey, special aerial surveys may be flown on an as needed basis, such as one flown in June 1998 for undetected blowdown as a result of the previous winter's strong winds.

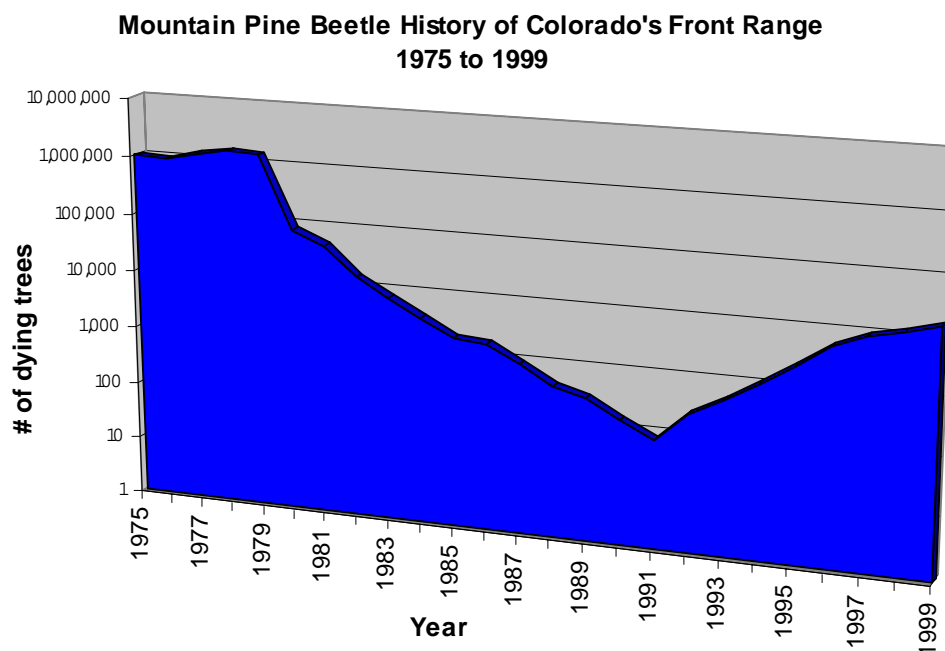
An average of 22 million acres are surveyed within Region 2 each year. Due to factors related to weather and wildfire activity, areas covered vary each year. The following table depicts acres flown during the 1997, 1998, and 1999 overview surveys by state:

State	Acres Flown 1997	Acres Flown 1998	Acres Flown 1999
Colorado	10.2 million	17.8 million	15.1 million
Nebraska	-	1.2 million	-
South Dakota	1.5 million	2.9 million	2.0 million
Wyoming	5.2 million	5.2 million	5.5 million
Regional Total	16.9 million	27.1 million	22.6 million

The following is a region-wide list of selected forest damage agents detected during the 1997, 1998, and 1999 annual overview surveys. Table entries do not include any of the most destructive diseases (e.g., root diseases and dwarf mistletoes) because these losses are not commonly detected by aerial surveys. With bark beetles, damage estimations are best attained by counting the number of dead "fader" trees. With most everything else, including defoliators, diseases, and abiotic events such as fire and windthrow, damage estimations are expressed in acres. Due to the subjective nature of aerial detection surveys, all figures reported in the following table should be regarded as ballpark estimates only.

Damage Agent	1997		1998		1999	
	Trees Killed	Acres Affected	Trees Killed	Acres Affected	Trees Killed	Acres Affected
Subalpine fir decline	154,400	-	491,000	-	456,700	-
Mountain pine beetle	39,200	-	88,300	-	188,300	-
Douglas-fir beetle	7,000	-	6,000	-	20,300	-
Spruce beetle	900	-	1,500	-	20,700	-
Western spruce budworm	-	500	-	22,000	-	41,600
Blowdown	-	20,000	-	5,600	-	400

The following graph of Colorado's Front Range shows a trend of tree mortality due to increasing levels of Mountain Pine Beetle. Past aerial survey records indicate the potentially high levels of mountain pine beetle damage the may occur in the Front Range and Region.



Obtaining Digital Aerial Survey Data

Region 2 aerial survey data going back to 1996 is available in digital format for use in a Geographic Information System (GIS) database. The files can be found at the following FTP address: ftp://ftp.fs.fed.us/incoming/r2/ro/aerial_survey/. Please note that the *entire* pathway must be typed initially. Download the forest damage coverage and the areas flown/not flown coverage. ArcView shapefiles, ArcInfo coverages, and .e00 file types are all available at this site. In addition to the GIS files, please open the folder entitled "meta_data" ftp://ftp.fs.fed.us/incoming/r2/ro/aerial_survey/meta_data/ and download the three documents explaining the fields in the polygon attribute tables (PAT):

- The *Aerial Survey Geographic Information System Handbook: Sketchmaps to Digital Geographic Information* (gis_handbook.pdf),
- The PAT explanation document (about_pat_table.xls),
- The USFS Region 2 "pest code" document (r2_pest_codes2000.doc).

The *Aerial Survey Geographic Information System Handbook: Sketchmaps to Digital Geographic Information*, is also available at the Forest Health Technology Enterprise Team's (FHTET) Forest Health website: http://www.fs.fed.us/foresthealth/id/id_guidelines.html (bottom of page).

For additional information regarding the GIS data, please contact Steve Gregonis sgregonis@fs.fed.us 303-275-5017, or Erik Johnson ejohnson02@fs.fed.us 303-236-8001.

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